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First record of *Amatitlania nigrofasciata* (Günther, 1867) (Cichliformes: Cichlidae) as introduced species in natural freshwaters of Colombia

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Abstract: *Amatitlania nigrofasciata* is a small freshwater fish species native to Central America. Is a popular ornamental fish that has been traded and cultivated for the aquarium industry, introduced into temperate and tropical regions across the world. Two specimens of *A. nigrofasciata* were collected from two small creeks draining into the Guavio River, upper Meta River in Mambita, Ubalá, Cundinamarca, Colombia in the Piedmont Orinoco ecoregion. This is the first record of *A. nigrofasciata* in natural freshwaters of Colombia and the Orinoco River basin. Diagnostic characters of species and updated distribution at country level are provided.

Key words: Orinoco Piedmont; Convict Cichlid; Meta River; Guavio River; Cundinamarca; ornamental fish; *Cichlasoma nigrofasciatum*

Amatitlania nigrofasciata (Günther, 1867), commonly known as convict cichlid or zebra cichlid, is a small (< 100 mm) freshwater fish species native to Central America in El Salvador, Guatemala and Honduras (Schmitter-Soto 2007a). This cichlid species inhabits lentic and lotic water bodies, commonly found among rocks, roots and debris (Froese and Pauly 2016). It is an omnivorous species with a carnivore tendency that feeds on crustaceans, aquatic insects, fishes and plant material (Trujillo-Jiménez 1998). It is a monogamous species that displays parental care of eggs and young, depositing in each spawn 100–150 eggs in rocky substrates (Mendoza et al. 2015). Because it is easily bred and maintained in aquaria, it has been commonly used as model for behavioral and physiological studies (Schmitter-Soto 2007a).

Amatitlania nigrofasciata is a popular ornamental fish that has been traded and cultivated for the aquarium industry around the world due to its aesthetic appearance (Trujillo-Jiménez 1998). As a result, it has been introduced into several countries including: The United States (Matlock 2014), Australia (Duffy et al. 2013), Mexico (Perez and Ramírez 2015), Iran (Esmaeili et al. 2015), Puerto Rico (Neal et al. 2009), Philippines (Kottelat 2013), Japan (Ishikawa and Tachihara 2010), Italy (Piazzini et al. 2010), Israel (Roll et al. 2007), Indonesia (Sentosa and Wijaya 2013), Réunion (Keith et al. 2006), Slovakia (Liptak et al. 2016), Germany (Jourdan et al. 2014) and Peru (Cossios 2010).

The presence of *A. nigrofasciata* in Colombia is only known from confined artificial waters such as aquaculture ponds and aquaria (Álvarez-León and Salazar-Salamanca 2001; Alvarado-Forero and Gutiérrez-Bonilla 2002; Baptiste et al. 2010; Gutiérrez-Bonilla and Álvarez-León 2011, Restrepo-Santamaría and Álvarez-León 2011; Restrepo-Santamaría and Álvarez-León 2013), and so far has not been found inhabiting natural freshwaters (Gutiérrez et al. 2012). Here we report for the first time the presence of *A. nigrofasciata* in natural freshwaters in Colombia and the Orinoco River basin.

Two leucistic specimens of *A. nigrofasciata* (Figures 1 and 2) were collected by electrofishing (SMITH-ROOT LR-24 Backpack Electrofisher) from two small creeks in Piedmont Orinoco freshwater ecoregion (Figures 3 and 4) draining into Guavio River, upper Meta River in Mambita, Ubalá, Cundinamarca, Colombia (Figure 5). Specimens were collected in October 2015, in a fish inventory as part of the project "Caracterización de la diversidad biológica en los predios de EMGESA, en cercanías a la inspección de Mambita en el municipio de Ubalá, Cundinamarca"; under research permit issued by Corporación Autónoma Regional del Guavio (CORPOGUAVIO) in "Resolución 69 del 24 de Septiembre de 2015". Specimens were fixed in 10% formalin and then preserved in 70% ethanol at "Colección de Peces

Figures 1 and 2: Live specimens of *A. nigrofasciata* collected. **1:** MPUJ 8462, 50.93 mm SL. **2:** MPUJ 8463, 52.9 mm SL.

Figures 3 and 4: Creeks where *A. nigrofasciata* was collected. **3:** Creek without name (MPUJ 8462 collected). **4:** Quebrada El Poblano (MPUJ 8463 collected).

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Amatitlania nigrofasciata (Günther, 1867)

Heros nigrofasciatus Günther, 1867

Cichlasoma nigrofasciatum (Günther, 1867) — Jordan and Everman (1898)

Archocentruss nigrofasciatus (Günther, 1867) — Allgayer (1994)

Cryptoheros nigrofasciatus (Günther, 1867) — Allgayer (2001)

Amatitlania coatepeque Schmitter-Soto, 2007a — McMahan et al. (2014)

Material examined: All from Mambita, Ubalá, Cundinamarca, Colombia: MPUJ 8462, 1, 50.93 mm SL, Creek without name (04.767388889° N, 073.32963889° W), 820 m a.s.l, 13 October 2015. MPUJ 8463, 1, 52.9 mm SL, Quebrada El Poblano (04.764583333° N, 073.32875° W), 827 m a.s.l, 7 October 2015.

Specimens were identified as *A. nigrofasciata* following identification keys and diagnosis provided by Schmitter-Soto (2007a, 2007b), along with comments from McMahan et al. (2014). *Amatilania* is distinguished from related genera by the following characters: 1) first body bar Y-shaped with caudal arm discontinuous; 2) body bars extending fully to the edge of dorsal and anal fin; 3) medial darker intensifications on second and third bars (sometimes also in first bar). Although, both specimens showed leucistic coloration in life; one of them exhibited a normal color bar pattern after it had been fixed in formalin (Figure 6).

Because some characters used by Schmitter-Soto (2007a) to elaborate keys and diagnosis are overlapping among species of *Amatitlania* (e.g., % of body depth in SL, circumpeduncular scales) or are internal characters (e.g., form of posterior end of dentigerous, peritoneal coloration, type of gut), they were not considered here for diagnosis of *A. nigrogaciata*. Only unique external characters that lead to its unequivocal identification were used. *Amatitlania nigrofasciata* is distinguished from *Amatitlania kanna* Schmitter-Soto, 2007a by the presence of secondary pores on the caudal fin (Figure 7); from *Amatitlania siquia* Schmitter-Soto, 2007a by

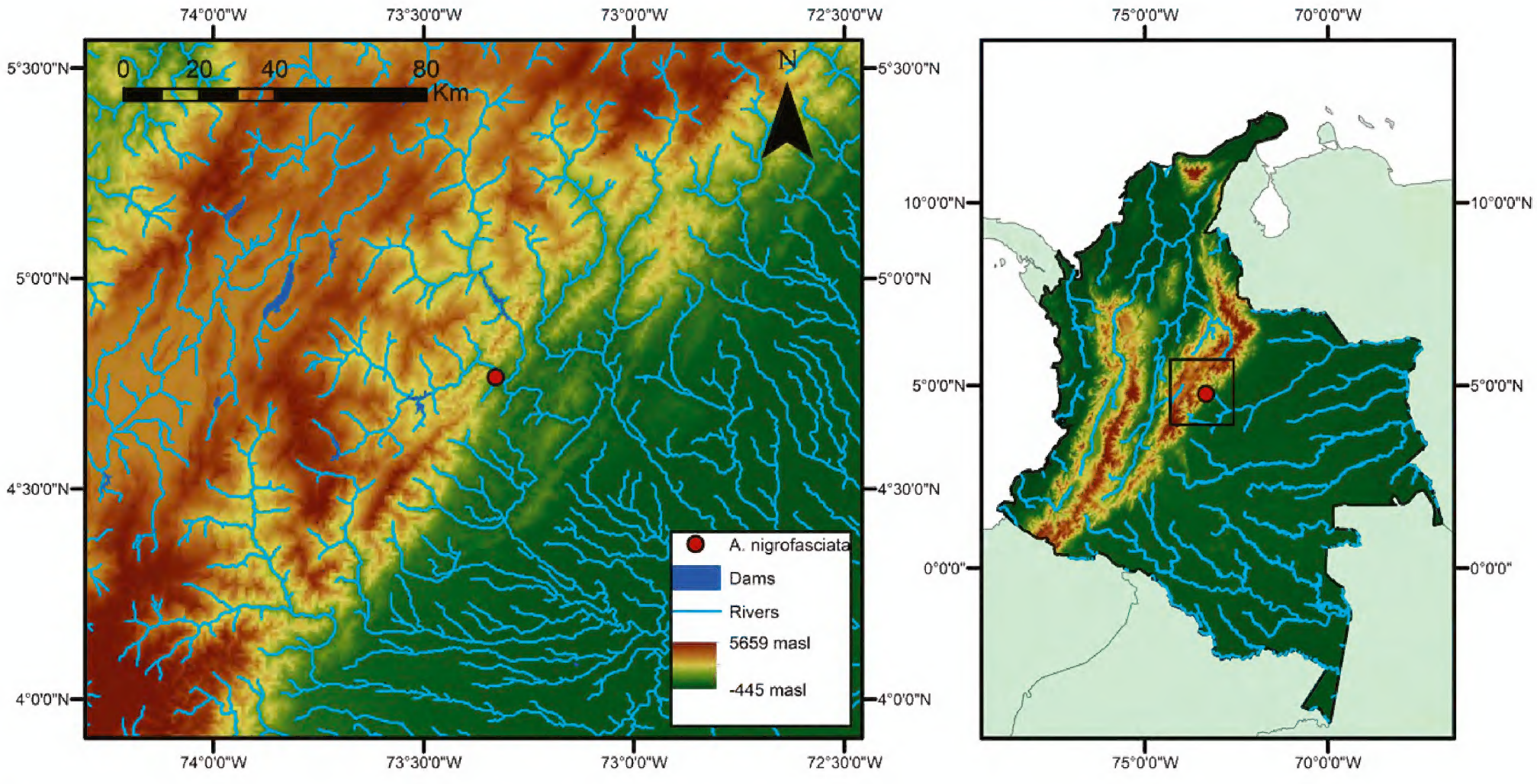

Figure 5: Record of *A. nigrofasciata* in Colombia. Red circle represents both localities.

Figure 6: Preserved specimen of *A. nigrofasciata* (MPUJ 8463) displaying body coloration pattern.

having the caudal blotch completely on the caudal fin (Figure 7) and 2 or 2.5 scales from the lateral line to first dorsal ray (MPUJ 8642: 2 scales MPUJ 8643: 2 scales). Schmitter-Soto (2007a) diagnosed *A. nigrofasciata* from all of its congeners by the presence of two rows of interradial scales in the distal portion of the anal fin (vs one). However, recent synonymization of *A. coatepeque* by McMahan et al. (2014) implies that *A. nigrofasciata* may have one or two rows.

Amatitlania nigrofasciata has been introduced to temperate and tropical regions around the world since 1920 (Piazinni et al. 2010) (Figure 8). The record presented here constitutes the second in natural freshwaters for South America, and the first for Colombia and the Orinoco River basin. The status of this exotic species in Colombia is regarded here as "introduced species" following terminology proposed by Gutierrez et al. (2012) for non-native freshwater species, considering that still there are no records of established and reproductive populations having negative environmental impacts, to be considered as invasive species. According to the most recent checklists of introduced freshwater

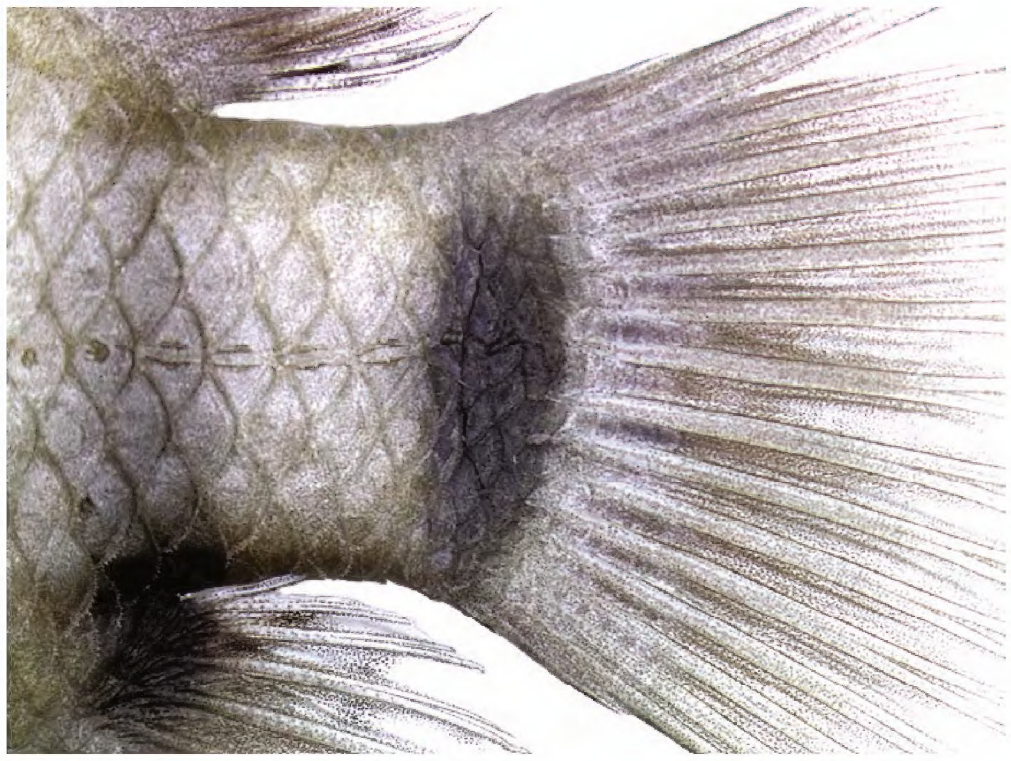

Figure 7: Detail of caudal peduncle of *A. nigrofasciata* (MPUJ 8463) showing the presence of secondary pores and caudal blotch on caudal fin.

species in Colombia (Gutierrez et al. 2012; Restrepo-Santamaría and Álvarez-León 2013) and present record of *A. nigrofasciata,* there are 48 non-native species inhabiting natural freshwaters of Colombia, 37 of which are freshwater fishes (7 transplanted and 30 exotics).

Introduction of *A. nigrofasciata* in natural freswaters of Colombia probably resulted from the release of ornamental fishes from aquacultures in the Mambita urban area. It is known that leucistic specimens of *A. nigrofasciata* are the result of selective breeding, and are commonly used for aquaria (Axelrod et al. 1989). *Amatitlania nigrofasciata* was collected along with native species (*Symbranchus marmoratus* Bloch, 1795, *Poecilia* cf. *reticulata* Peters, 1859, *Rhamdia quelen* (Quoy & Gaimard, 1824) and *Bryconamericus* Eigenmann, 1907) and other exotic ornamental species (*Xiphophorus helleri* Heckel, 1848). However, common found species that are restricted and specialized to these piedmont streams (e.g., *Creagrutus atratus* Vari & Harold, 2001, *Hemibrycon metae* Myers, 1930, *Astroblepus* Humboldt, 1805 and *Dolichancistrus fuesslii* (Steindachner, 1911) were absent. It is interesting to note that both creeks where *A. nigrofasciata* was collected are used by surrounding houses to discharge wastewater. This suggests that habitat degradation could be contributing to the loss of native species, and possibly facilitating the establishment of non-native species. Habitat degradation by human intervention has been shown to be a factor strongly related to establishment of non-native fishes in natural freshwaters (Light and Marchetti 2007; Leprieur et al. 2008).

Although there is no evidence of self-sustaining and expanding populations of *A. nigrofasciata* in freshwaters of Colombia, this species is potentially a serious threat for native species. *Amatitlania nigrofasciata* has been considered a species with a high risk of invasion (Magalhaes and Jacobi 2013; Mendoza et al. 2015) and a quick colonizer in freshwater ecosystems (Ishikawa and Katsunori 2010; Esmaeili et al. 2015). It is a tolerant and prolific species (Ishikawa and Katsunori 2010; Trujillo-Jiménez et al. 2010), that once established might be difficult to eradicate (e.g., Hill and Cichra 2005; Hovey and Swift 2012). In other countries, it has been found reaching invasive category with strong established populations alongside native species (e.g., Piazzini et al. 2010; Trujillo-Jiménez et al. 2010; Mejía-Mojica et al. 2015). The aggressive and territorial behaviour and omnivorous diet of this species could serve to compete

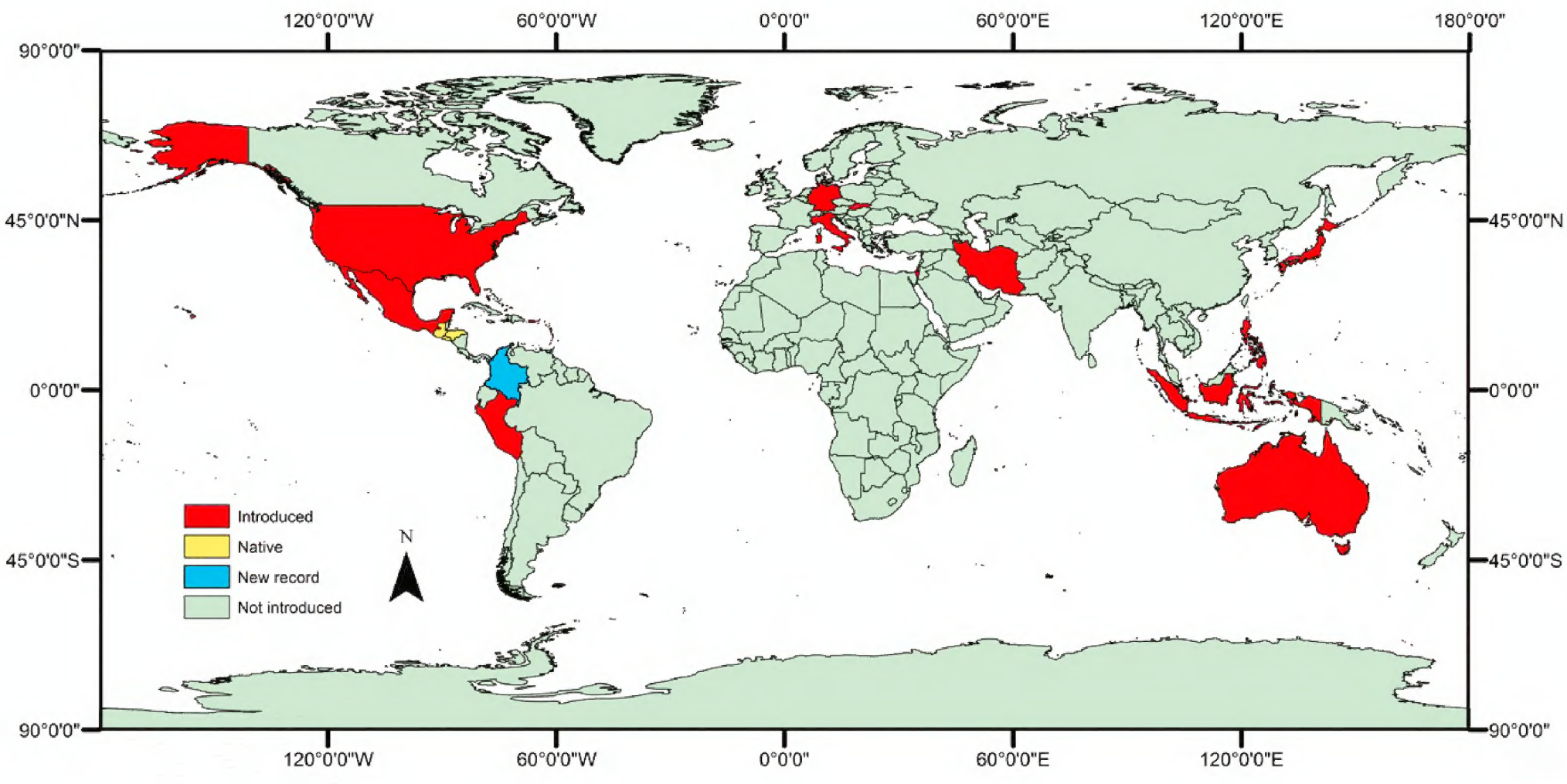

Figure 8: Current distribution of *A. nigrofasciata* at country level based on records reported on literature.

with native species (Mendoza et al. 2015). For example, in the Balsas River basin in Mexico, *A. nigrofasciata* is a well established introduced dominant species that has displaced important species for fisheries (*Amphilophus istlanus* (Jordan & Snyder, 1899) and *Ictalurus balsanus* (Jordan & Snyder, 1899)) (Contreras-MacBeath 1998) and also displays a high diet overlap with other native species (*Notropis moralesi* de Buen, 1956 and *Poecilia butleri* Jordan, 1889) (Medina-Nava et al. 2011). Future efforts in monitoring and controlling the establishment of *A. nigrofasciata* must be addressed to avoid possible negative impacts in Colombian freshwater ecosystems.

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